REPORT

ON

OPENING OUT NAVIGATION

FROM

RICE LAKE TO BAY OF QUINTE

BY

MR. SAMUEL KEEFER, C. E.

AND

MR. JAMES LYONS, C. E.

1882
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Mr. James Lyons' Report.

Report on the practicability of connecting the Reach above Heely's Falls and the Bay of Quinte by a Canal inland, and using those sections of the River which are at present navigable.

The strong objections against damming the bed of a river in any instance, particularly where there is a strong current, rendered it necessary to make a most careful examination of the country between Heely's Falls and Crow Bay. A ravine was pointed out by the inhabitants which has always been considered practicable, and which is shewn on the plan of this section. In the hope of finding it so, regardless of its distance, I commenced a line of levels, and at a distance of 33 chains and 85 links from the river, arrived at a level 11.76 feet above the top of the dam, and at the distance of 1 mile, 42 chains and 59 links, obtained a level 51 feet above the same point. I then had to return to the bed of the river.

No. 2.—The plan and section will shew the plan proposed for its improvement; its cost, as per estimate, will amount to £46,255.-10s. 5d., which will carry the navigation to Crow Bay, a very fine sheet of navigable water not less than 10 feet deep at its lowest level. The distance from Heely's to Crow Bay by the bed of the river is 1 mile, 35 chains and 40 links, and the difference of level, lowest water, 79.246 feet.

No. 3.—The next section inland is from Crow Bay to Percy Landing, a distance of 8 miles, 69 chains and 29 links, with a difference of level, 153,102 feet. The shape of the ground selected is admirably adapted, which will appear by an examinatiou of the section; the cuttings and embankments are not great, but entirely through solid rock, and the cost as per estimate, amounts to £112,738 12s. 11d.

No. 4.—From Percy Landing the river is made navigable by the lock at Chisholm's Rapids for a distance of about 14 miles, from thence to Widow Harris' it is not navigable, there being two bars with only 3½ feet of water covering them; but, by the improvement embraced in the estimate of the 3rd and following section, its navigation will be made complete; the probable distance is 6 miles, 42 chains and 70 links.

No. 5.—From Widow Harris' to the point near the mouth of the river, where the first lock was originally proposed, (and which is in part excavated from thence towards the river,) a distance of 7

miles, 77 chains and 30 links inland, and the difference of level 110,472 feet, will cost, as per estimate, £96,309. 19s. 8½d., making the cost of the improvement from Heely's Falls to the Bay of Quinte amount to £255,304. 3s. 0½d., and making the navigation from Peterborough to the mouth of the Trent complete, and to correspond with the vessels adapted for the Rideau canal.

No. 6.—As before observed, the section throughout the whole of the inland route could not be much more favourable as far as regards the shape of the land in its course; it crosses very few streams, and it happens that the surface of the largest of these comes on a level with the surface level of the canal, and can be discharged in their former beds without any extra expense.

No. 7.—In the first location of the inland route, trifling savings may be effected by slight deviations from the line presented.

(Signed,) JAMES LYONS.

Estimate of the probable cost of constructing a Canal inland, to connect Heely's Falls and the mouth of the River Trent; 40 feet wide at bottom in rock, perpendicular sides; slopes on embankment two to one; locks 135, 33 x 5.

SECTION 1.—From Heely's Falls to Crow Bay, along the bed of the river, 1 mile, 35 chains and 40 links in length, difference of level; lowest water, 79,246 feet.

	£	s.	d.
Entrance Pier	130	1	0
Coffer Dam at Heely's	44	0	0
Rock excavation	5,795	1	3
Three Dams	4,527	17	0
Stone Dam in ravine	95	0	0
Stone Walls at lock	3,466	10	0
Coffer Dam at Crow Bay	340	0	0
Two locks, combined, 10 feet, including gates, &c.	7,027	0	0
One lock, single, 14 feet, including gates, &c.	4,174	0	0
" " 9 " " "	3,242	10	0
" " 14 " " "	4,174	0	0
" " 7.25 " " "	3,335	10	0
" " 8 " " "	3,431	10	0
" " 8 " " "	3,431	10	0
Pumping water to hang lock gates, &c	15	0	0
	43,229	9	3
Add 7 % for contingencies and unforseen expenses	3,026	1	2
Total of first section	46,255	10	05

SECTION 2.—From Crow Bay to Percy Landing; length 8 miles, 69 chains and 29 links; difference of level, 153,102 feet.

First mile	9,458	3	8
Second mile	7,950	17	5
Third mile	3,914	14	9
Fourth mile	7,800	4	10
Fifth mile	7,812	16	10
Sixth mile	6,315	9	9
Seventh mile	5,150	10	2
Eighth mile	5,072	6	8
69 chains and 29 links	6,025	17	4
Piers for stop-logs	156	13	0
1 Lock, 12 feet lift, including gates, &c	3,547	0	0
1 " " " " "	3,547	0	0
1 " " " " "	3,547	0	0
3 " combined, 36 feet lift "	9,107	10	0
1 " single, 14 " "	3,823	0	0
1 " " 14 " "	3,823	0	0
1 " " 9 " "	2,926	0	0
1 " " 10.75 " "	3,374	10	0
1 " " 12 " "	3,730	0	0
1 " " 9.21 " "	2,951	10	0
Culverts, bridges, &c	5,329	0	0
	105,363	4	5
Add 7 % for contingencies and unforseen expenses.	7,375	8	6
Total of second section	112,738	12	11

SECTION 3.—From Widow Harris' to the mouth of the Trent. Length 7 miles, 77 chains and 30 links. Difference of level 110.-472 feet.

First mile	2,117	10	8
Second mile	4,686	19	7
Third mile	7,476	1	6
Fourth mile	6,984	6	5
Fifth mile	7,650	10	10
Sixth mile	6,061	13	7
Seventh mile	6,826	7	5
77 chains and 30 links	9,071	9	8½
Piers for stop-logs, &c	156	13	0
1 Lock, 12 feet lift, with lock-gates, &c	4,072	0	0
1 " " " "	3,547	0	0
1 " 10 " "	3,271	0	0
1 " 14 " "	3,824	10	0
1 " 10 " "	3,271	0	0

2 " combined, 14 and 12 feet lift, with lock-gates, &c.	6,605	10	0
1 " single, 14 feet lift, " "	3,824	10	0
1 " " 14.27 " " "	3,889	0	0
Culverts, bridges, &c., &c.	6,673	4	0
	90,009	6	8½
Add 7 % for contingencies and unforseen expenses.	6,300	13	0
Total of third section	96,309	19	8½
Total amount of the three sections	255,304	3	0½

Nothing allowed for engineering, superintendence or damages for land.

(Signed,) JAMES LYONS.

Mr. Samuel Keefer's Report.

BOARD OF WORKS,
Montreal, 23rd April, 1846.

SIR,—In reference to Mr. Lyons' survey for a canal to connect the reach above Heely's Falls, upon the Trent River, with the Bay of Quinte, I have the honor to report as follows:—

The Otonabee, which empties itself into Rice Lake, about 12 miles from its lower end, has been made navigable as far up as Peterborough, and the object of the present survey was to ascertain the practicability and expense of connecting the Rice Lake with Lake Ontario, by an inland canal of the same size as the Rideau, corresponding with which the locks upon the Otonabee and Trent have been built.

The difference of level between Rice Lake and Lake Ontario is about 365 feet, so that the whole fall to be overcome is 35 feet more than that of the Welland canal, which is 330 feet.

The lock at Crooks' Rapids, situated at the foot of Rice Lake, overcomes a fall of 8 feet, and opens a navigation of 53 miles in extent, from Peterborough to Heely's Falls, at which place the present survey begins.

Between Heely's Falls and the mouth of the Trent, another reach of 20½ miles of this river has been made navigable, by means of a lock at Chisholm's Rapids, the fall of which is 8¾ feet.

This navigable portion of the Trent extends from Percy Landing nearly down to the Widow Harris'; and in order to complete the navigation it is necessary to construct a canal from Heely's Falls to Percy Landing, the distance by the river being 12½ miles, and the fall 232 feet; and another from Widow Harris' to the mouth of the Trent, the distance by the river being 9 miles, and the fall, in that distance, 110½ feet.

In the first survey of the Trent, made by Mr. Baird in the year 1833, he proposed to make this river navigable by means of a series of locks and dams, and, in accordance with his plans, the three locks above mentioned and the dams with which they are connected were undertaken by the Commissioners, and have since been completed under the direction of the Board of Works, for the purpose of taking advantage of the long reaches of the river which are made available by their means. But since the erection of the slides upon the Trent, and the great impetus that has been given to the lumber trade in consequence, it has now become sufficiently apparent that the system of locks and dams is neither a suitable nor a safe one to be adopted for this navigation. Nor would it be wise, (even supposing that the immense quantities of timber descending the Trent could be conducted down it without injury to the works,) to expend so large a sum as would be necessary to make this navigation, when the essential structures upon which its very existence depends, viz., the dams, are subject to annual and sudden floods, and the failure of only one of which might possibly cause the destruction of the whole.

In making the present survey it was, therefore, laid down as a fixed principle that the canal should be made inland, and beyond the influence of the floods; and, notwithstanding it was evident from the formation of the country that both shores of the river were composed of stratified limestone, it was considered as the only safe and proper mode of accomplishing the end in view.

From various reports made to me of the existence of ravines which afforded facilities for making the canal around Heely's Falls, I hoped to be able to find an inland route from thence to Percy Landing; but, after much time and pains spent by Mr. Lyons in the search, no such favourable line could be found. He was therefore under the necessity of resorting to the bed of the river itself as the only practicable means of surmounting the obstacles to the navigation presented between Heely's Falls and Crow Bay. This portion of the river comprehends his *First Section*, which is one mile and 35 chains long, and the fall, which is 79¼ feet, is proposed to be overcome by eight locks. His estimate for this section is £46,255 10s. 5d.

I am fully persuaded, however, that this part of his plan will not answer, both on account of the interference of the lumber trade with his proposed navigation, as well as the danger to which

his works must be subject in consequence of floods and descending timber and masts.

In the first place, his navigation would be stopped or suspended during the running season for timber; and in the second place, it is in danger of being totally destroyed. If no better route than this can be found, this section must be reported as impracticable; but I am not prepared to prononnce it so, because I conceive that at an additional expense it is possible to carry the canal along the brow of the hill until the level of the table land on the west side is attained, and then to descend from it into Crow Bay.

The survey made by Mr. Lyons was completed too late in the season to admit of further examinations upon this point.

The *Second Section* of Mr. Lyons' survey is as favorable as could be expected, when it is taken into consideration that the line for the canal must necessarily pass through rock cutting; and he has been enabled to select a very good line upon the west side of the river, out of reacn of the floods, and away from the bank of the river. The fall, in this distance, is 153 feet, and can be overcome by 12 locks. His estimate for it is £112.738 12s. 11d.

The *Third Section*, from the Widow Harris' to the Bay of Quinte, is also as favourable as can be expected from the rocky nature of the country through which it must pass.

The route selected is upon the west side of the river, and the selection appears to have been judiciously made. The length of this section is very nearly nine miles; the fall is 110½ feet, and is surmounted by nine locks. His estimate for it is £96,309 19s. 8d.

The entire length of canal, comprehended in these three sections, is 18¼ miles; the total fall to be overcome is 342¾ feet; the number of locks required is 29; and the total cost is estimated by Mr. Lyons at £255,304 3s. 0d.

Upon a careful review of the estimates, I am convinced that Mr. Lyons has not made sufficient allowance for the difficulties to be encountered in carrying the proposed works into execution. I have taken the sections furnished by him, calculated the quantities, and affixed prices, such as works of the same class, now under contract with the Board, have been taken at, and in this manner my estimate is—

For the 1st section.....	£ 65,455	0 0
" 2nd "	189,383	0 0
" 3rd "	144,465	0 0
Total	£399,303	0 0

This amount is exclusive of land damages, which it is impossible to estimate with any degree of certainty.

It is unnecessary to take up your attention with the details of this estimate, or to point out all the differences between this and the one furnished by Mr. Lyons; but I will merely observe that a lock of 12 feet lift, 135 feet long in the chambers, 33 feet wide, and with 4½ feet of water on the sills, including gates and working gear complete, is estimated by Mr. Lyons at £3,547, and by me at £4,700.

After the experience of the last six years as to the cost of stone locks in various parts of the Province, I am quite safe in stating that locks of the size and description required for this navigation cannot be built for the sum stated by Mr. Lyons. Those of the Welland Canal have cost upwards of £6,000 each.

I have therefore to observe in conclusion, that according to the best judgment I can form of the projected improvement of the Trent, my opinion is that it would require an appropriation of £400,000 to cover the cost of it, independently of the expense of land damages; but that as regards the other two sections it may be found, upon further examination, that a trifling deviation may be made in the line, by which the canal may be improved without additional expense.

I have the honor to be Sir,

Your obedient servant,

(Signed,) SAMUEL KEEFER,
Engineer, Board of Works.

The Hon. Hamilton H. Killaly.